

Advanced Flow Analysis Tools for Transient Solid Rocket Motor Simulations, Phase II

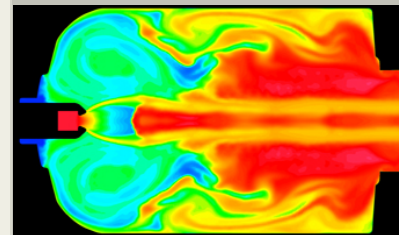
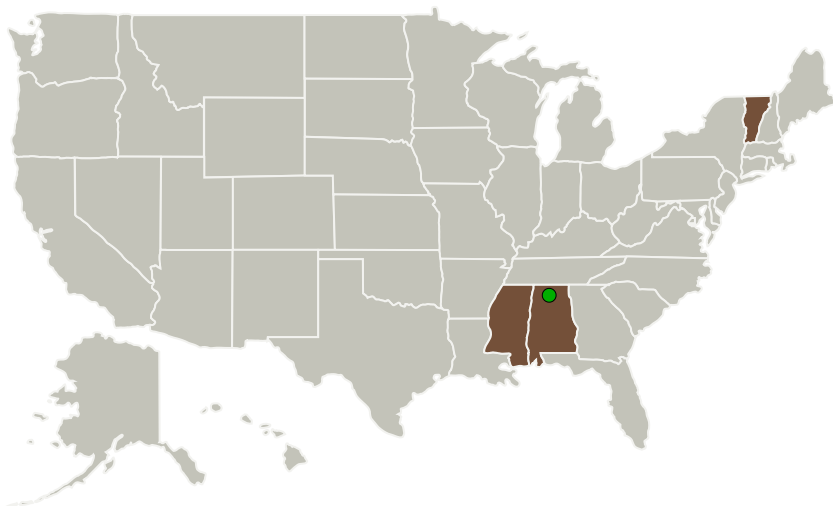
Completed Technology Project (2012 - 2014)



Project Introduction

The goals of reducing total cost and increasing reliability and safety of access to space continue to be top priorities for NASA. The most immediate propulsion launch challenge involves increasing lift weight from 70 to 130 metric tons by developing the heavy lift Space Launch System (SLS). Solid rocket motor analysis tools are needed to simulate ignition and propellant recession during the burn, but current models are limited in their ability to capture ignition transients or large grain deformations during motor operation. We propose to advance propellant surface heating, ignition, and burning models as well as surface mesh recession algorithms to address a strong need for improved ignition physics and grain burn back and to deliver a unique and powerful software tool for current and next generation solid rocket motor simulations. The Phase I products have already been fielded by NASA for ignition calculations involving the Launch Abort System Jettison Motor and RSRMV. While these calculations are still in the preliminary stages, continued innovation of this successful technology strongly suggests that our research products will provide NASA with the important capability to simultaneously analyze solid propellant heat transfer, combustion, and grain burn back within a single framework. Validation of the integrated tools to a TRL of 5 will be accomplished using available motor data provided by ATK while phased releases of the new software capabilities will allow NASA immediate access to incremental updates as soon as they are available. Advancing this simulation capability will provide a large benefit to NASA because of its compatibility with NASA's mission and expertise.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Tetra Research Corporation	Lead Organization	Industry Women-Owned Small Business (WOSB)	Princeton, Illinois
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Tetra Research Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Robert R Chamberlain

Co-Investigator:

Rex Chamberlain

Primary U.S. Work Locations

Alabama	Mississippi
Vermont	

Project Transitions

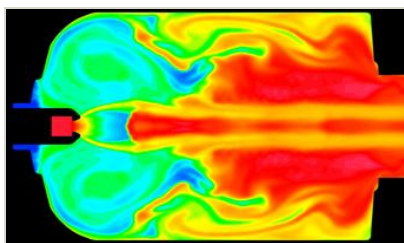
▶ **June 2012:** Project Start

✓ **September 2014:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137883>)

Images

**Project Image**

Advanced Flow Analysis Tools for Transient Solid Rocket Motor Simulations

(<https://techport.nasa.gov/image/135930>)

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Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.1 Chemical Space Propulsion
 - └ TX01.1.5 Hybrids

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System